Space Weather Technical Forecast

Issued on Saturday 16 November 2024 at 12:17 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated R1/R2 radio blackouts possible. Slight chance of G1/Minor Geomagnetic Storm intervals.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate during the past 24-hours with two M-class flares observed, with a peak flare of M1.6 at 16/0137 UTC from AR3889 in the southwest. AR3893 in the southeast also produced an M1.0 flare at 15/1218 UTC.

There are currently three numbered sunspot regions on the visible disc, with one unnumbered emerging east of AR3889. AR3889 is the largest region on the disc, located in the southwest quadrant. It comprises of fairly large but widely separated lead/trailer portions, with the intermediate spots having increasingly diminished. The former small delta spot in the trailing portion is tenuously weak, and shows signs of separating soon. The remaining regions are small and magnetically simple.

No Earth-directed CMEs were observed over the past 24 hours in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE were indicative of a weak high speed stream, reaching between 340-460km/s. Density was mostly, but briefly increased to above average values, peaking at 12 ppcc between 15/1700-1900 UTC. The interplanetary magnetic field (IMF), Bt, was mostly weak with some brief moderate increases, with a peak of 10nT at the start of the period. The north-south component, Bz was predominantly negative at weak to moderate levels, peak -7nT. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 2-3), with an Active (Kp 4) interval 16/0100-0300 UTC.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at low to moderate levels. The associated 24-hour fluence remained below the Active threshold. The integrated flux observed at 16/0000 UTC was 5.03e6.

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Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity expected, with a chance of M-class flares and a slight chance of X-class flares, most likely from AR3889.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

Background to slightly elevated solar wind speeds are expected, although from late Day 2 (17th) there is a chance of elevated wind speeds of around 500km/s occurring with a further connection to a HSS. Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 2-3) initially, with a chance of Active (Kp 4) intervals and a slight chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals. From later Day 2 (17 Nov) activity activity expected to increase slightly, becoming Unsettled to Active (Kp 3-4) with an increased chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is at background levels. There is a slight chance of S1/Minor solar radiation storms due to the potential for flaring from AR3889 as it rotates across the western hemisphere.

The high energy electron flux is expected to remain at predominantly background to moderate levels, although there is a chance of reaching high levels during diurnal peaks later in the period. The associated fluence is expected to remain below Active (1e8 integrated flux) levels.

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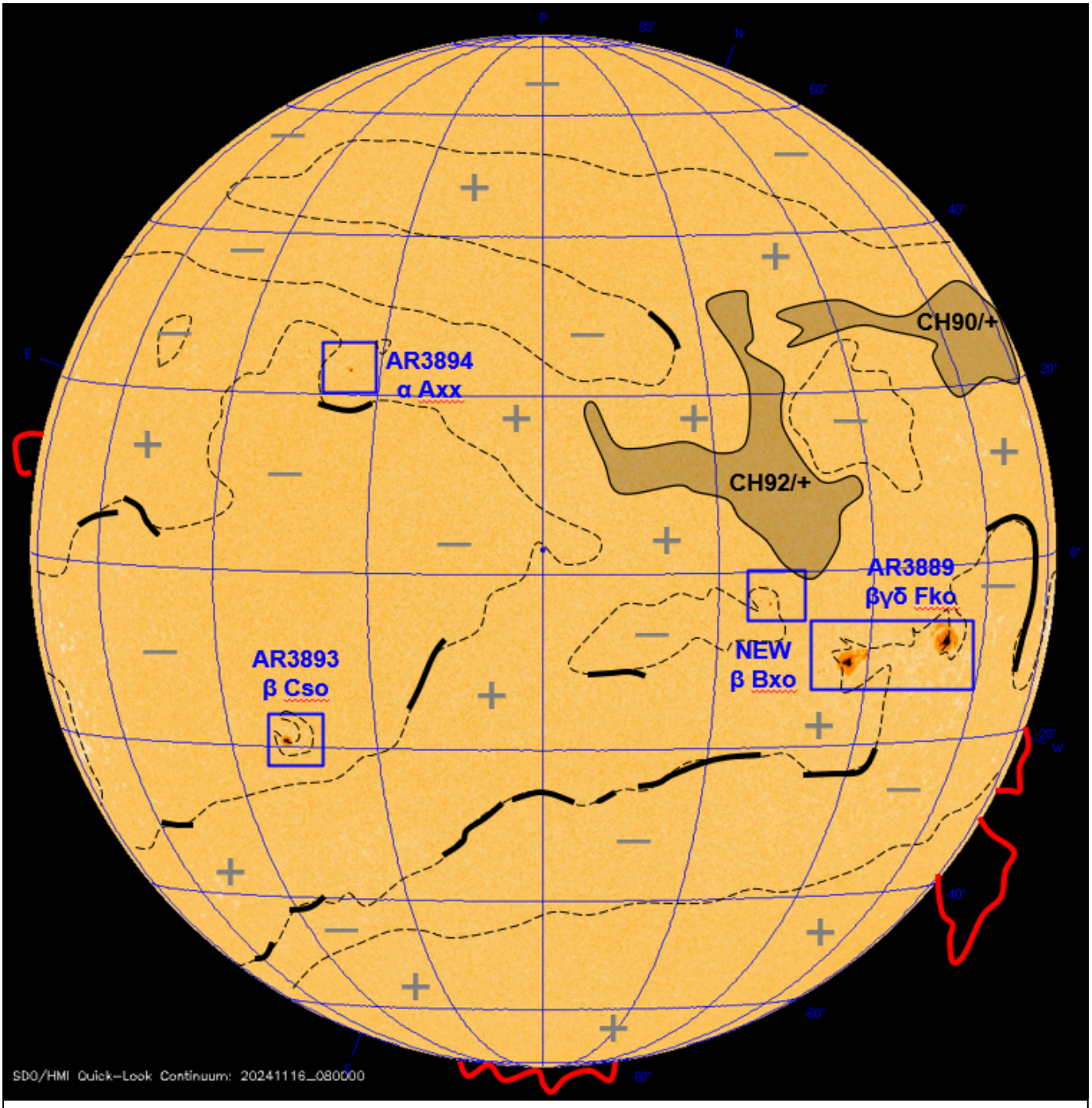
Figure 1: Solar Synoptic Map Valid 16/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

The forecast comprises primarily of coronal hole influences. Continued transitory connections to a HSS from CH90/+ is expected, as Earth likely brushes along the southern boundary of this coronal hole, bringing a risk of slightly elevated solar wind speeds, mainly Day 1 (16th). From late Day 2 (17th) there is a likelihood of elevated wind speeds of around 500km/s occurring with a connection to a HSS from CH92/+. This feature is slightly larger compared to last rotation, when speeds of around 450 km/s occurred, and a general increase also suggested by MOSWOC ENLIL output.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 2-3) initially, with a chance of Active (Kp 4) intervals and a slight chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals. From later Day 2 (17 Nov) activity activity is expected to increase slightly, becoming Unsettled to Active (Kp 3-4) with an increased chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	10	20	20	10
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

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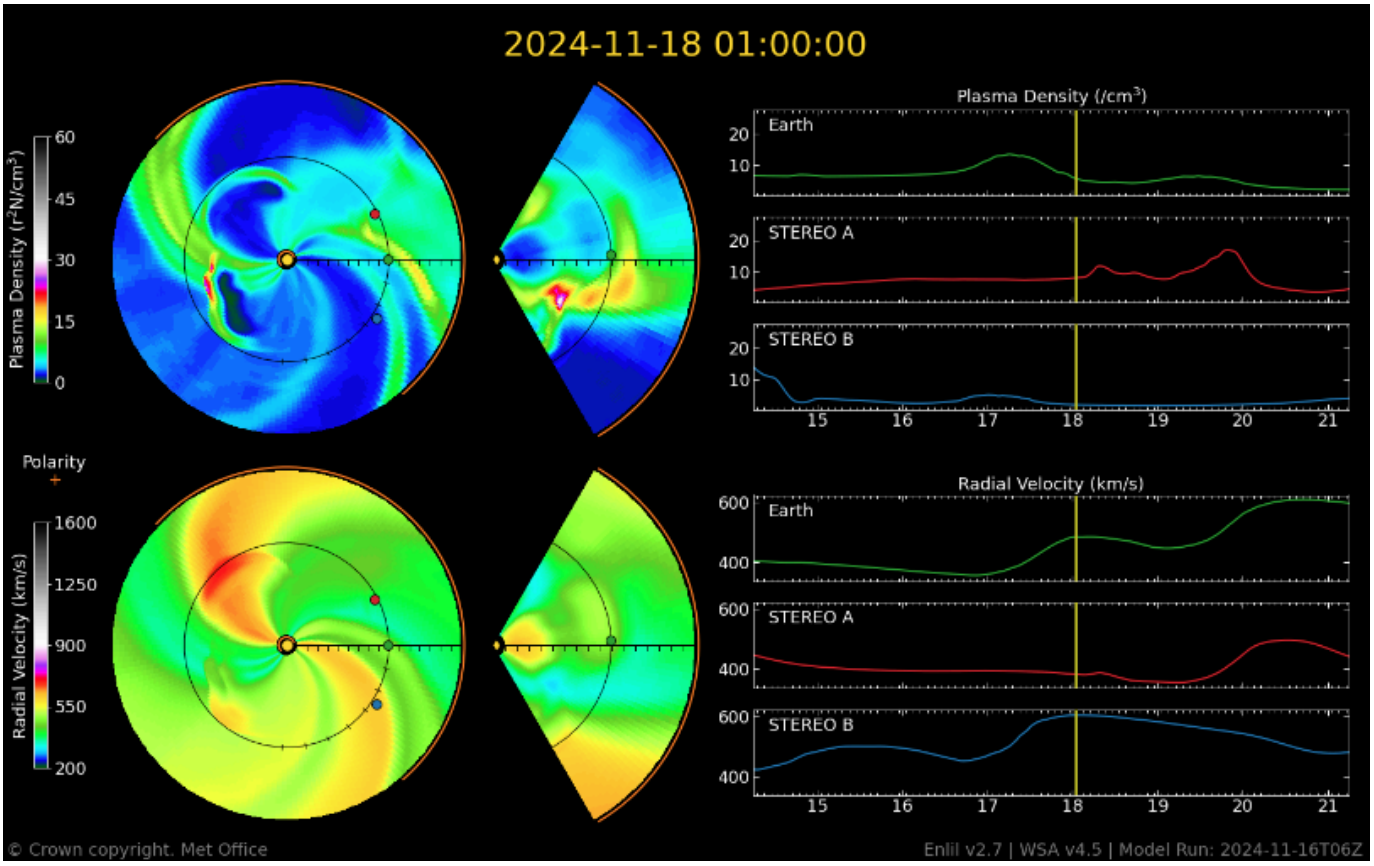
Figure 2: MOSWOC Enlil output.



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Radio Blackouts - X-Ray Flares

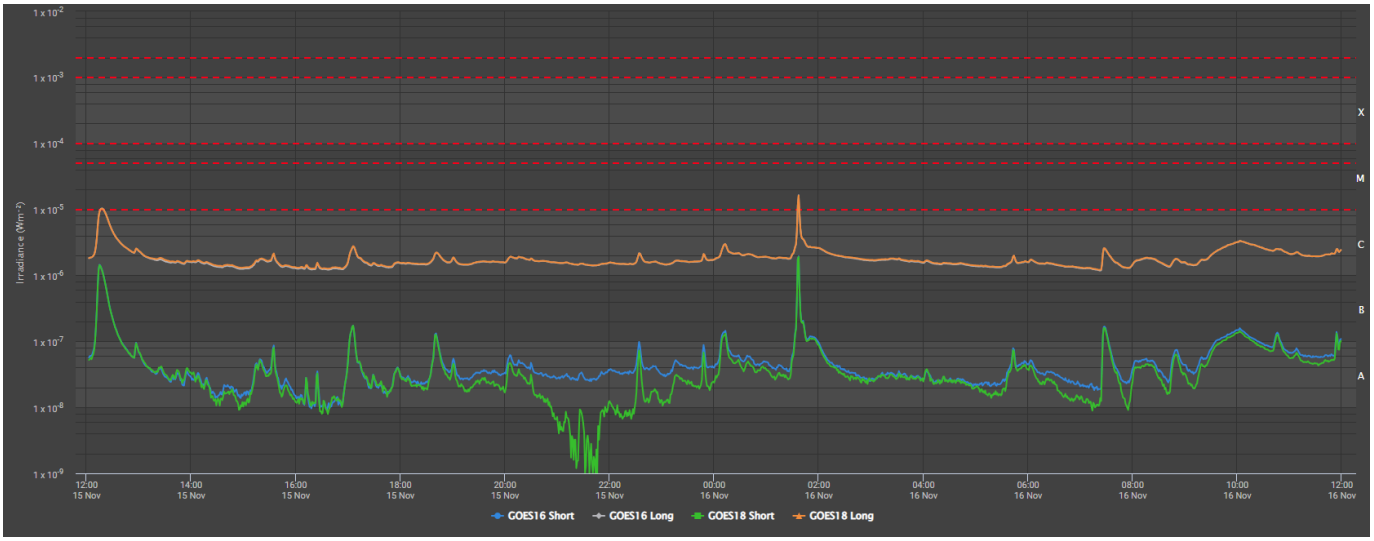
AR3889, in the southwest, maintains the bulk of the current flare risk, but this perhaps reducing somewhat given the apparent simplification of the region. The remaining regions are small and magnetically simpler, although the recent M1 flares from region AR3893 in the southeast show that they can not be completely discounted.

No particularly large far side regions suggested by far-side sounding data, however recurrence suggests the potential for sunspot regions to return to the visible disk from perhaps later Day 1 (16 Nov) onward. This supported by some brightening of the western limb in SDO/AIA imagery and recent far-sided CMEs observed.

Overall Low to Moderate activity is expected, with a chance of isolated M-flares and a slight chance of X-flares, most likely from AR3889 to start. From Day 2 (17 Nov) in the forecast period potential returning regions increase the forecast likelihood of significant flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	30	40	40	40
Very Active	R3-R5 (X Class)	No	5	10	10	10

Figure 3: GOES16-18 X-Ray flux trace.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is at background levels and is expected to remain that way during the period in the absence of any significant flare activity.

There is a slight chance of S1/Minor Solar Radiation storms or greater over the period, chiefly due to any potential significant flaring from AR3889 as it transits across the western hemisphere.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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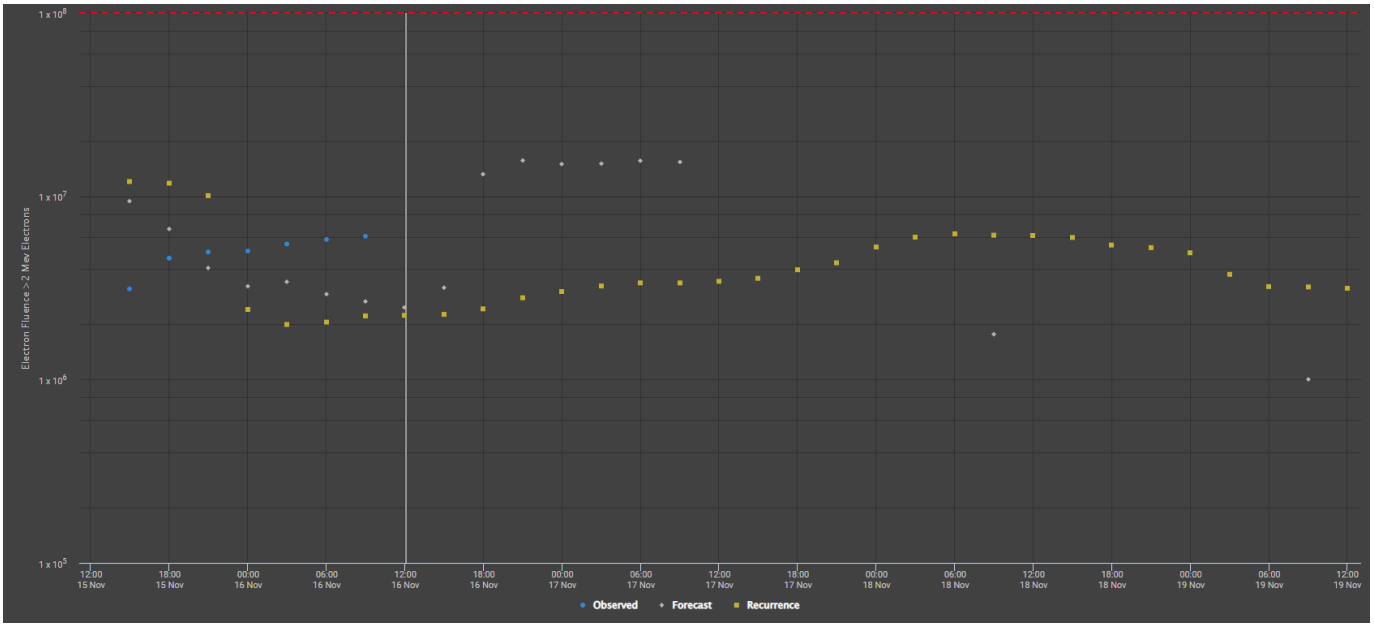
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at background to moderate levels, with no change expected, apart for a slight chance of temporarily reaching high levels during diurnal peaks.

The associated fluence is expected to remain below Active (1e8 integrated flux) levels, with perhaps a gradually rising trend. Therefore the guidance shown by MOSWOC's REFM model is considered reasonable guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	10
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: MOSWOC Electron fluence



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